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portion 3 and also as a rotary shaft of the rotor portion 4. As seen in FIG.1, a left-hand portion of the main shaft 5 functions as the drive shaft of the motor portion 3, whereas a right-hand portion of the main shaft 5 functions as the rotary shaft of the rotor portion 4. Since the drive shaft and the rotary shaft are integrally formed in this manner, the interconnection of these shafts is unnecessary so that the pump may be downsized with respect to an axial direction. The main shaft 5 has its axial opposite ends rotatably supported by bearings 10, 16 mounted in the housing 2.

The housing 2 is formed of a steel sheet and has an arrangement wherein a motor housing 7 principally accommodating the motor portion 3 is connected with a rotor housing 8 principally accommodating the rotor portion 4.

The motor housing 7 is shaped like a cylinder which has a close face 9 on one axial side (opposite side from the rotor portion 4; the left-hand side as seen in FIG.1) and an open face on the other axial side. A roller bearing (first bearing) 10 for rotatably supporting an axial end 5a of the main shaft 5 is disposed centrally of the one axial face 9 of the motor housing 7. The first bearing 10 has an outer ring 10a mounted to the motor housing 7, and an inner ring 10b mounted to the main shaft 5.

The rotor housing 8 is divided into a first section 11 and a second section 12 which are arranged in an axial direction of the main shaft 5 and connected with each other. The first section

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11, assembled to the open face at the other axial end of the motor housing 7, is hermetically mated against the motor housing 7 by means of a seal 14 but is disengageably connected/fixed to the motor housing 7 by means of a bolt 15. A joint face 11a of the first section 11 with the second section 12 is formed with a recess 17 hollowed in a direction of thickness of the first section 11 (the axial direction of the main shaft 5), the recess defining a rotor chamber accommodating the rotor portion 4. The recess 17 includes a peripheral surface 17a eccentric relative to the main shaft 5. Furthermore, the recess is formed with a through-hole 18 at the center of a bottom 17b thereof, the through-hole extended toward the motor housing 7 in the direction of thickness of the first section 11 (the axial direction of the main shaft 5). Thus, the main shaft 5 is inserted through the through-hole 18. The first section 11 is provided with a seal member 18a fitted about the main shaft 5 for sealing the rotor chamber 17 against an interior of the motor housing 7.

The second section 12 is pressed against the joint face 11a of the first section 11, whereas joint faces of the first section 11 and the second section 12 are sealed with a seal 19. The first section 11 and the section 12 are disengageably connected/fixed to each other by means of a bolt 20.

The second section 12 is provided with a roller bearing (second bearing) 16 for rotatably supporting the other axial end

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A second bearing for supporting the other axial end of the main shaft 5 is constructed as a sliding bearing wherein an outer peripheral surface of the outer rotor 25 is in sliding contact with a housing peripheral surface 17a supporting the outer peripheral surface.

The main shaft 5 is rotatably supported by the housing peripheral surface 17a, which acts as the second bearing via the inner rotor 26. The housing peripheral surface 17a is finished to have a surface roughness Ra on the order of 1.6 or less in order to provide for a favorable sliding motion of the outer rotor 25. Although not supplied with an additional lubricant, the second bearing is maintained in a favorable lubrication condition by means of oil in the rotor chamber 17.

According to the second embodiment, out of the bearings for the main shaft 5 that need be mounted to the axial opposite sides of the rotor 23 of the motor portion 3, one bearing (the second bearing, or the bearing on the other axial end side) is incorporated in the rotor portion 4 itself (the outer periphery of the outer rotor defines the sliding bearing). Therefore, it is unnecessary to provide the bearing on the other axial side of the motor portion 3. That is, the bearing between the motor portion 4 and the rotor portion 4 is not required.

Accordingly, the pump may be reduced in the axial length. In addition, the number of bearings is decreased so that the reduction of components is accomplished. Thus is provided a

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portion 3 and also as a rotary shaft of the rotor portion 4. As seen in FIG.1, a left-hand portion of the main shaft 5 functions as the drive shaft of the motor portion 3, whereas a right-hand portion of the main shaft ~~6~~ 5 functions as the rotary shaft of the rotor portion 4. Since the drive shaft and the rotary shaft are integrally formed in this manner, the interconnection of these shafts is unnecessary so that the pump may be downsized with respect to an axial direction. The main shaft 5 has its axial opposite ends rotatably supported by bearings 10, 16 mounted in the housing 2.

The housing 2 is formed of a steel sheet and has an arrangement wherein a motor housing 7 principally accommodating the motor portion 3 is connected with a rotor housing 8 principally accommodating the rotor portion 4.

The motor housing 7 is shaped like a cylinder which has a close face 9 on one axial side (opposite side from the rotor portion 4; the left-hand side as seen in FIG.1) and an open face on the other axial side. A roller bearing (first bearing) 10 for rotatably supporting an axial end 5a of the main shaft 5 is disposed centrally of the one axial face 9 of the motor housing 7. The first bearing 10 has an outer ring 10a mounted to the motor housing 7, and an inner ring 10b mounted to the main shaft 5.

The rotor housing 8 is divided into a first section 11 and a second section 12 which are arranged in an axial direction of the main shaft 5 and connected with each other. The first section

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~~12~~ 11, assembled to the open face at the other axial end of the motor housing 7, is hermetically mated against the motor housing 7 by means of a seal 14 but is disengageably connected/fixed to the motor housing 7 by means of a bolt 15. A joint face 11a of the first section 11 with the second section 12 is formed with a recess 17 hollowed in a direction of thickness of the first section 11 (the axial direction of the main shaft 5), the recess defining a rotor chamber accommodating the rotor portion 4. The recess 17 includes a peripheral surface 17a eccentric relative to the main shaft 5. Furthermore, the recess is formed with a through-hole 18 at the center of a bottom 17b thereof, the through-hole extended toward the motor housing 7 in the direction of thickness of the first section 11 (the axial direction of the main shaft 5). Thus, the main shaft 5 is inserted through the through-hole 18. The first section 11 is provided with a seal member 18a fitted about the main shaft 5 for sealing the rotor chamber 17 against an interior of the motor housing 7.

The second section 12 is pressed against the joint face 11a of the first section 11, whereas joint faces of the first section 11 and the second section 12 are sealed with a seal 19. The first section 11 and the section 12 are disengageably connected/fixed to each other by means of a bolt 20.

The second section 12 is provided with a roller bearing (second bearing) 16 for rotatably supporting the other axial end

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A second bearing for supporting the other axial end of the main shaft 5 is constructed as a sliding bearing wherein an outer peripheral surface of the outer rotor 25 is in sliding contact with a housing peripheral surface 17a supporting the outer peripheral surface.

The main shaft 5 is rotatably supported by the housing peripheral surface 17a, which acts as the second bearing ~~17a~~ via the inner rotor 26. The housing peripheral surface 17a is finished to have a surface roughness Ra on the order of 1.6 or less in order to provide for a favorable sliding motion of the outer rotor 25. Although not supplied with an additional lubricant, the second bearing ~~17a~~ is maintained in a favorable lubrication condition by means of oil in the rotor chamber 17.

According to the second embodiment, out of the bearings for the main shaft 5 that need be mounted to the axial opposite sides of the rotor 23 of the motor portion 3, one bearing (the second bearing ~~17a~~, or the bearing on the other axial end side) is incorporated in the rotor portion 4 itself (the outer periphery of the outer rotor defines the sliding bearing). Therefore, it is unnecessary to provide the bearing on the other axial side of the motor portion 3. That is, the bearing between the motor portion 4 and the rotor portion 4 is not required.

Accordingly, the pump may be reduced in the axial length. In addition, the number of bearings is decreased so that the reduction of components is accomplished. Thus is provided a